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RESULTS OF A SPRAY TREATMENT FOR THE CONTROL OF THE BLACK PINE-LEAF SCALE INFESTING PONDEROSA PINE ON THE SAN BERNARDINO NATIONAL FOREST

by

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Forest Insect Laboratory
Berkeley 4, California
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Distribution and Importance in California

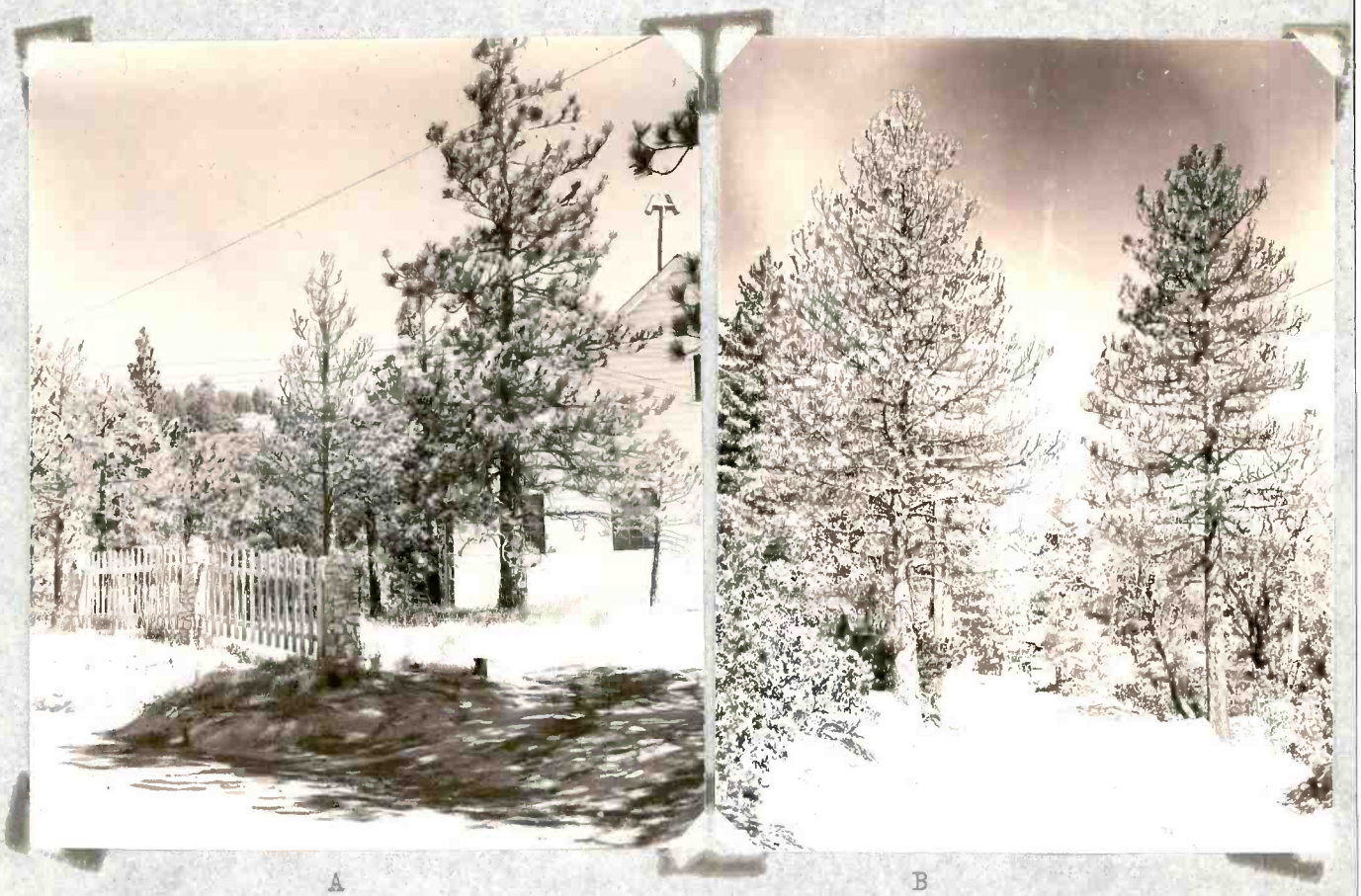
The black pine-leaf scale, Nuculaspis californica (Coleman) is generally distributed throughout the range of ponderosa pine in California and in local areas causes serious damage to young pine stands (1). This scale has been particularly abundant in recent years in the Crestline Area of the San Bernardino National Forest where it has caused considerable damage, resulting in death of young ponderosa pine trees in recreational areas and around dwellings located in the forest. (Figure 1 and 2) The Forest Service and local property owners have been greatly concerned about this damage and have requested information on practical control measures.

Description and Habits

The black pine-leaf scale belongs to the group of armored scales. There is very little known about its life history. Apparently there is but one generation a year in the Crestline Area. The young "crawlers" hatch in the spring and crawl about in search of food. When they have found a suitable spot on a needle they insert their mouth parts, after which the first molt takes place resulting in a loss of legs and antennae and they assume their stationary form. The second molt results in the initiation of the armor formation which continues to increase in size as the insect matures. The scale covering is nearly all black except for a small lighter colored cap on top. The scale covering of the male when mature is slightly larger and more elongated than the one covering the female. The male scale when mature emerges from under the armor covering and moves freely about. He is equipped with a pair of delicate wings and may be capable of flight. The female remains under her armor when mature and produces eggs, these hatching into tiny nymphs that crawl out to re-infest new needles. Preliminary population counts indicate that the female scales outnumber the males by about ten to one.

Spray Control Tests

On July 12, 1941, H. L. McKenzie carried on some preliminary spray tests for the control of this scale near the Hat Creek Field Laboratory in Shasta County. At that time he tested several materials and found among those tested that a highly refined petroleum oil plus a toxic of cube resins dissolved in cardolite gave a very promising control. He also found that this material had no apparent injurious effect on the pine foliage. The infestation of the scale in this area, however, was comparatively light and it was decided to duplicate this work in 1942 in an area where the scale was abundant. The area selected for the repeat test was the Crestline Area of the San Bernardino National Forest.



A B

FIGURE 1

A Black pine-leaf scale damage to young ponderosa pine near a dwelling in Crestline village, San Bernardino National Forest. Small tree at right edge of picture, the one in the center (behind the stone post), and group at extreme left severely damaged.

B Black pine-leaf scale damage to ponderosa pine in recreational area near Seeley Camp in the San Bernardino National Forest. Tree on the left severely injured; the one of the right moderately injured.

A B

FIGURE 2

A A cluster of 1943 needles moderately infested with the black pine-leaf scale, an average of about 20 scales per needle.

B Greatly magnified needle with heavy scale population.

On June 9, 1942, H. L. McKenzie and R. C. Hall conducted a series of tests on heavily infested trees in this area. The materials used in this experiment were the cube resin dissolved in light petroleum oil and oil alone. This work was carried on in cooperation with the U. S. Forest Service and the University of California's Citrus Experiment Station at Riverside, California. Twenty-one heavily infested trees were used in this test. Eight tested the oil plus toxic, eight tested the straight oil alone and five were used as checks.

Results the First Season After Treatment

Counts of scale made from specimens submitted by Ranger George Lang about a month after treatment showed very promising results. At the time of this count, the female scales had laid their supply of eggs and practically no living female scales could be found, even on the check trees. For this reason it was impossible to determine the effectiveness of the spray on the adults. However it was decided to determine the effectiveness of the spray by using the ratio of the number of newly settled scales to the number of old scale bodies. The check series showed a population of 29 old scale bodies per needle prior to treatment, and an average of 27 new scale bodies or a ratio of .93 (Table 1). The oil plus toxic showed an average population of 39 old scale bodies per needle which was reduced to a new population of 0.5 scales per needle or a ratio of .013. The oil treatment alone showed an average population of 20 old scales per needle and a new population of 0.09 scales per needle or a ratio of .005. For these data the straight oil appeared to have been more effective than the oil plus the toxic. This apparent superiority may have been due to sampling or to the difference in the density of the scale population. The population of old scales on the trees treated with oil and toxic was approximately double that on the trees treated with straight oil, averaging 39 and 20 scales per needle respectively.

Results the Second Season After Treatment

During the last week of March 1944, F. P. Keen visited this area and collected a series of needles from most of the trees. Counts of these were made to determine the population of scales on the 1943 needles. A summary of these results are shown in Table 1, where it may be noted that the check trees had an average population of 37 scales per needle; the oil and toxic 1.89 scales per needle and the straight oil 1.42 scales per needle. On a ratio basis of the number of scales the second season after treatment / number of scales prior to treatment, these show for the check 1.28; for oil plus toxic .048 and for the straight oil .071.

Table 1. Summary of the results of spray treatment at Crestline for the 1942 and 1943 season.

Treatment	No. of trees	Average Number Scales Per Needle			RATIO	
		Prior to Treatment (1941 Needles)	1st Season after Treatment (1942 Needles)	2d Season after Treatment (1943 Needles)	1st Season after Treatment / Prior to Treatment	2d Season after Treatment / Prior to Treatment
Check	5	29	27	37	0.93	1.28
Oil + Toxic 1/	8	39	0.50	1.89	0.013	0.048
Oil alone 2/	8	20	0.09	1.42	0.005	0.071

1/ Highly refined oil #3 (light medium) - 2 gallons + Blood albumin spreader 4 oz. + toxic solution cube resins dissolved in cardolite (contains 16 percent cube resins, which resins contain 30 percent rotenone) - 1 pint + water to make 100 gallons.

2/ Same as No. 1 except toxic solution eliminated.

The results of counts of scales on individual trees are shown in Table 2 where an attempt has been made to assess the control effect. These data appear to show that the effect of the spray the second season after treatment was not so effective as for the first season, but still the population of scales on the sprayed trees is so low that they are probably not causing any appreciable injury except in local branches. Keen's observation on these trees was that the spray had been on the whole very effective, but that certain trees showed local branches where the scale was still abundant. This may have been due to the spray coverage not being entirely uniform.

Both Lang and Keen observed that there had been no apparent injury to the pine foliage from the spray material.

Conclusions

These tests indicate that effective control with one application of spray material is possible for at least two seasons and probably much longer. If the scale population is effectively reduced on a tree, it is likely to remain in that status for a number of years because of the habits of this particular insect. The females move after maturity and the only chance of reinfestation would probably be through the young "crawlers" being carried on the legs of birds or squirrels. It seems unlikely that these fragile young would of themselves migrate from tree to tree except in the case of interlocking branches. Therefore it appears that one application of spray which would effectively cover all branches and needles would furnish satisfactory control for a number of years.

References

(1) Essig, E. O. Insects of Western North America. The MacMillan Co. N. Y. 1926

(2) Ferris, G. F. Atlas of the Scale Insects of North America. Stanford Univ. Press. 1938

Table 2. Results of spray treatment on individual trees at Crestline for the 1942 and 1943 seasons

Treatment	Tree Number	Average Number Scales per Needle 1941	1942	1943	Control Effects
Check. No treatment	2	64	71	52	
	3	45	28	22	
	12	11	14	54	
	15	14	16	25	
	16	13	5	32	
	Average	29	27	37	
Oil + Toxic	1	50	1.45	0.75	Uniformally effective
	4	29	.04	2.40	Effective on all but a few branches
	5	18	.04	*	
	6	47	.08	*	
	7	26	.02	*	
	8	38	0.40	0.65	Uniformally effective
	17	28	.44	4.40	Generally effective, 1 branch heavily infested in 1943
	18	75	1.55	1.25	Generally effective
	Average	39	.50	1.89	
Straight oil	9	9	.06	.70	Uniformally effective
	10	11	.10	*	
	11	27	.10	.25	Uniformally effective
	13	33	.08	1.70	Generally effective
	13A	5	.04	.30	Uniformally effective
	14	22	.00	.25	Uniformally effective
	19	29	.24	*	
	20	27	.00	5.35	Effective except for a few infested branches in 1943
	Average	20	.09	1.42	

*No 1943 samples collected

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